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Computational thinking: A reflection on the symposium by an early career researcher in undergraduate mathematics education

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Something(s) that struck me

I have attended three major in-person events on learning and teaching in undergraduate mathematics since summer 2022. While the sample size of the events is small, for me, the symposium on *Coding, Computational Modeling, and Equity in Mathematics Education* tops the list. What a week it was! What an organizing team!

The organizing committee put on a great academic event and made all participants feel welcome. The symposium offered me a personal and professional opportunity to learn and reflect on a new research area - *Computational Thinking*.

One thing that struck me is the fact that computational thinking transcends K-12, post-secondary, and undergraduate mathematics education. Yet, evidence from my classroom practice suggests that coding is not necessarily an enjoyable activity for most undergraduate mathematics students. I therefore wonder what we could do to motivate lower level students to see the need for them to develop coding competency and computational thinking skills. This calls for some further research work on task selection and task design.

I enjoyed the event so much that I did not want it to end. I wanted more time at Brock to learn about MICA, and shadow one lower level as well as one upper level undergraduate mathematics student; and hear more about some of the work the Brock team have done including their contributions to *Educational Studies in Mathematics.* Nonetheless, I returned to my affiliated institution inspired and re-invigorated to carve a research path that I hope will widen participation in undergraduate mathematics education.

Something(s) I learned or gained

I had not read any paper on *Computational Thinking* before the symposium, and I did not have the knowledge base to engage in any intellectual debate on the topic. So, to get up to speed with the subject, the University of York, *not* York University, came to my rescue at https://online.york.ac.uk/what-is-computational-thinking/. This article describes computational thinking in a way that will entice anyone new to the subject to engage with it. After attending the symposium and engaging with the professional development day and working group activities, I have also come to believe that undergraduate mathematics faculty need to emphasize in their teaching the "four Cs" of 21st century learning – communication, critical thinking, collaboration, and creativity (Grover, 2018) – and coding in relevant mathematics courses is a place to start. As an academic tribe, the undergraduate mathematics faculty of which I am part, still have a challenge and a long way to go to ensure that their students are fully prepared for new and emerging careers that draw on computational thinking. The reason for this is because much of our practice – teaching and assessment – privileges tests and exams, correct answers, procedural knowledge, and routine tasks over creativity, debate, and open-ended tasks.

At the professional development day, I gained working knowledge of coding at the Callysto Hub platform. Since then, I have introduced my undergraduate students to the platform as an alternative to R Studio. I see an opportunity for an outreach programme at Toronto Metropolitan University for high school students within the GTA area.

Something(s) I now wonder

I have always been interested in quantitative social science, computational social science, and computational statistics. We know that Data Science has become an emerging field with new careers on the horizon. I wonder if we could offer a mathematics course that focuses on addressing social problems through the application of mathematics and/or statistics. I think such a course will require computational thinking skills, and yet it will be unique and distinct from data science.

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